Amendments to the Claims:

Claims 21-32 are pending in this application. Claim 21 is independent.

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-20 (CANCELLED):

21 (CURRENTLY AMENDED): A cooling apparatus for cooling an optical element of an optical system provided in a vacuum atmosphere, said apparatus comprising:

a radiational member, arranged apart from the optical element, to receive heat from the optical element by radiational heat transfer;

a Peltier element contacted to said radiational member with a heat absorbtion surface to cool said radiational member;

a control system configured to control temperature of ~~a first surface, contacting said radiational member, of~~ said radiational member by controlling temperature of said Peltier element; and

a heat transfer system contacted to a heat radiation surface of said Peltier element to flow a coolant via a ~~second surface, opposite to the first surface, of~~ a circulation channel thereby transferring heat from said Peltier element,

wherein said heat transfer system ~~keeping~~ maintains temperature of the coolant substantially the same as a ~~reference~~ predetermined temperature of the optical system.

22 (PREVIOUSLY PRESENTED): An apparatus according to claim 21, further comprising a detector for detecting temperature of the optical element, wherein said control system controls the temperature of the surface based on the temperature detected by said detector.

23 (PREVIOUSLY PRESENTED): An apparatus according to claim 21, wherein said heat transfer system flows the coolant through a block provided on the second surface.

24 (PREVIOUSLY PRESENTED): An apparatus according to claim 21, wherein the optical element is a mirror.

25 (PREVIOUSLY PRESENTED): An apparatus according to claim 24, wherein said radiational member faces a rear surface of the mirror.

26 (PREVIOUSLY PRESENTED): An apparatus according to claim 21, further comprising a radiation shield member to shield radiational heat transfer between said radiational member and an object different from the optical element.

27 (PREVIOUSLY PRESENTED): An apparatus according to claim 21, wherein the reference temperature is a target temperature of one of the optical element and a reference position member.

28 (PREVIOUSLY PRESENTED): An exposure apparatus having an optical system and exposing an object to a pattern using said optical system, an optical element included in said optical system being provided in a vacuum atmosphere, said apparatus comprising:

a cooling apparatus, for cooling said optical element, as defined in claim 21.

29 (PREVIOUSLY PRESENTED): An apparatus according to claim 28, wherein said optical element is an element of an illumination optical system for illuminating an original corresponding to the pattern.

30 (PREVIOUSLY PRESENTED): An apparatus according to claim 28, wherein said optical element is an element of a projection optical system for projection a pattern of an original to the object.

31 (PREVIOUSLY PRESENTED): An apparatus according to claim 28, wherein said optical system directs a light having a wavelength within rage of 10 nm to 15 nm.

32 (PREVIOUSLY PRESENTED): A device fabrication method comprising steps of:

exposing an object to a pattern using an exposure apparatus as defined in claim 28; and developing the exposed object.